JPRS 78366

24 June 1981

USSR Report

ENGINEERING AND EQUIPMENT

No. 76

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Indexes to this report (by keyword, author, personal names, title and series) are available through Bell & Howell, Old Mansfield Road, Wooster, Ohio, 44691.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

Soviet books and journal articles displaying a copyright notice are reproduced and sold by NTIS with permission of the copyright agency of the Soviet Union. Permission for further reproduction must be obtained from copyright owner.

JPRS 78366

24 June 1981

USSR REPORT

ENGINEERING AND EQUIPMENT

No. 76

CONTENTS

NUCLEAR ENERGY

Enlargement of High-Pressure Heaters for High-Power Units in Atomic Electric Power Plants With Water-Moderated Water-Cooled Power Reactors.. 1

NON-NUCLEAR ENERGY

Modes of Startup and Shutdown of the New PT-135/165-130/15 Turbine With Central Heating.. 2

INDUSTRIAL TECHNOLOGY

Adaptive Control System for a Robot-Manipulator.......................... 3

HIGH-ENERGY DEVICES, OPTICS AND PHOTOGRAPHY

Rotation Rate Stabilizer for the Motor of a High Speed Photorecorder.... 4

Scanner for Optical Instruments.. 4

Laboratory Installation for the Creation of a Laser Probe............... 5

Installation for Study of Electron Energy Transfer Between Excited States in Donor-Acceptor Systems....................................... 5

High Voltage Unit of a Short X-Ray Pulse Generator With a Three-Electrode Tube... 6

Installation for Measurement of Magnetization in Strong Pulsed Magnetic Fields... 6

Installation for Low Temperature Spectral Studies in Strong Pulsed Magnetic Fields... 7

Photoreceptor With Good Background Radiation Stability.................. 7

Dielectric Charged Particle Detector With KCl Working Substance........ 8

Processing of Glass Track Detectors With the MAGMD Installation........ 8

High Speed Positron Lifetime Spectrometer.............................. 9

Measurement of Functions of Excitation of Nuclear Reactions in a Beam With a Broad Energy Spectrum.. 9

Device for Uniform Bombardment of the Surfaces of Specimens With a Beam of Ions From an Accelerator...................................... 10

Microwave Electron Injector.. 10

System for Stabilization and Control of the Energy of a Betatron....... 11

Errors in Radiation in Cylindrical Simulators of the Thermal Effect of Planets on Cylindrical Flight Vehicles............................ 11

Increase in Dimensions of Operating Zone of a Simple Planetary Radiation Simulator by the Use of a Conical Mirror................... 12

FLUID MECHANICS

Influence of Viscosity on Flow Around a Sharp Edge of Segmentally Conical Bodies... 13

Discharge of a Viscous Gas From a Cylindrical Channel into Vacuum...... 14

Shape of a Body Disintegrating in a Supersonic Gas Stream.............. 14

Approximate Method of Solution for Nonlinear Problems of Dynamics of a Fluid in a Vessel Moving in a Given Mode............................. 15

Calculation of the Force Acting on Part of a Body in a Supersonic Gas Jet in the Presence of an Accompanying External Supersonic Flow...... 15

Temperature Field of a Plate With Local Heat Sinks, Heated by a Laminar Flow of a Compressible Gas.................................... 16

Influence of Archimedes Force on Length of Mixing Zone of a Free Turbulent Jet.. 16

MECHANICS OF SOLIDS

Asymptotic Expression for the Natural Frequencies of Noncircular Cylindrical Shells Filled with Fluid................................. 18

Diffraction of Acoustic Waves by an Ideal Shield Inside a Plane Waveguide With Thin Elastic Walls..................................... 18

Libration Points Near a Gravitating Rotating Triaxial Ellipsoid........ 19

Vibration Modes of a Long Cylinder in the High-Frequency Range......... 20

Damping the Vibrations of Mechanical Systems by Means of Cavities Partly Filled With Loose Material.. 20

Traveling Waves in Longitudinally Reinforced Cylindrical Shells........ 21

Stability of an Incompressible Elliptical Cylinder Under Finite Strains.. 21

Transient Interaction of an Elastic Spherical Body and an Acoustic Medium... 22

Optimal Control of Vibrations of Plates and Shallow Shells as a Problem of Mathematical Programming.................................. 22

Predicting the Carrying Capacity of Cylindrical Glass Shells From the Results of Nondestructive Tests Under Internal Pressure.............. 23

Distribution of Forces in a Triple-Layer Rolled Pipe.................. 23

Vibration Diagnosis of Gas-Turbine Blades Based on the Limiting Levels of Torsional Runner Vibrations.. 24

Transient Radial Vibrations of a Piecewise-Homogeneous Elastic Space With Spherical Symmetry.. 25

Transient Thermoelastic Stresses in a Rotating Cylinder................ 25

Stability of Viscoelastic Shallow Spherical Shells Under a Varying Load... 26

Linear Axisymmetric Response of a Compound Shell of Revolution to an Impact Load.. 26

Asymptotic Analysis of Problems Pertaining to Free Vibrations of a Cylindrical Shell in Contact With an Elastic Medium.................. 27

Unsteady Temperature Field of an Orthotropic Cylinder With Mixed Boundary Conditions.. 28

TESTING AND MATERIALS

Thermal Stabilization of Optical Characteristics of Plastic Scintillators.. 29

NUCLEAR ENERGY

UDC (621.311.25:621.039):621.182.14-11.001.2

ENLARGEMENT OF HIGH-PRESSURE HEATERS FOR HIGH-POWER UNITS IN ATOMIC ELECTRIC POWER PLANTS WITH WATER-MODERATED WATER-COOLED POWER REACTORS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 2, Feb 81 pp 12-13

MARUSHKIN, V. M., candidate of technical sciences, POLYNOVSKIY, Ya. L., candidate of technical sciences, and SHKOL'NIK, G. T., candidate of technical sciences, All-Union Thermotechnical Institute, Ural branch

[Abstract] Vertical collector-type heaters of the "Krasnyy Kotel'shchik" design are now used for 220 MW units in atomic electric power plants with water-moderated water-cooled power reactors. They are 2600 mm in diameter and 10.6 m high, not large enough for 500-1000 MW units. A horizontal construction has been considered but would, for technological reasons, require austenitic steel. The vertical collector-type PV preheater now used in 500 MW thermal electric power plants is found to be adequate for heating the feed water to 220°C in two stages, its inside diameter of 3200 mm and height of 14 m also accommodating a 0.7 MPa deaerator. A single-channel version is now being adapted for use in atomic electric power plants such as the Novovoronezhsk and the South Ukraine plants where it is preferred to a two-channel 3-stage version with a 1.2 MPa deaerator. Studies made so far indicate that the key item is changing to smaller tubes, 20x3 or 22x3 mm, as elements of the heating surface. With the present 3200 mm diameter but a height of 14.5 m, this heater including a 0.7 MPa deaerator should be adequate for 1000 MW atomic electric power plants. The maximum velocity of the feed water through the coils will not exceed 2 m/s and the maximum length of tube per coil will be 13 m. The entire heater will weigh 250 metric tons. More ways to enlarge high-pressure heaters should be possible by using a chamber design. Figures 2, references 4 Russian.
[88-2415]

NON-NUCLEAR ENERGY

UDC 621.165.6-57-783.617.004.13

MODES OF STARTUP AND SHUTDOWN OF THE NEW PT-135/165-130/15 TURBINE WITH CENTRAL HEATING

Moscow ELEKTRICHESKIYE STANTSII in Russian No 2, Feb 81 pp 30-34

PASHNIN, V. M., engineer, POKHORILER, V. L., candidate of technical sciences, and FISKIND, E. E., engineer, Ural Regional Administration of Power System Engineering Management, Ural Polytechnic Institute

[Abstract] The new PT-135/165-130/15 steam turbine is a machine with three pressure stages and a central heating system. Live steam at 550(565)°C enters under a pressure of 13 MPa, the maximum rate is 760 t/h. It can be bled for production use (1.5-0.3 MPa) and for preheating the feed water. Thermal stresses are most critical in the check valve of the high-pressure stage, this valve having an appropriately heavy wall thickness. These stresses due to an unavoidable stepwise pressure buildup were studied on the basis of a computer-aided solution of the axisymmetric problem of thermoelasticity by the finite element method, with simple relations between stresses and temperature differences obtained through an evaluation of the data by the method of least squares. Various modes of startup were considered, including the preheating stage as well as the subsequent acceleration and loading stages. Most severe but least frequently occurring is startup from the cold state, this condition too having been considered in the analysis. Shutdown was considered with forced cooling, this device being used for reducing lost time. Curves of pressure, temperature, and temperature differences as functions of time obtained as a result of these calculations indicate how the startup and the shutdown can be optimized in terms of duration without exceeding the permissible level of thermal stresses. Accordingly, it is feasible to accelerate the runner of a cold or still warm turbine within 40-60 min and to reduce the turbine cooling time from 100 h with natural cooling only to 20-24 h with forced air cooling. Figures 5, references 8 Russian.
[88-2415]

UDC 621.7.067-52

ADAPTIVE CONTROL SYSTEM FOR A ROBOT-MANIPULATOR

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 1, Jan-Mar 81 pp 30-33 manuscript received 19 Nov 79

KOVALEV, Ye. L., engineer

[Abstract] A hierarchical 2-level adaptive control system for a robot-manipulator is described which enables the latter not only to perform repetitive operations, specifically to sort pieces in production lots, but also to cope with any arbitrary sequence of objects as well as with changes in their properties or contents and with changes in the technological requirements. The system consists of an information and measuring part with a scanner operating in real time on the lower level with the automatic feed mechanism and an automatic classifier with a special-purpose computer on the higher level. The computer calculates the discriminant functions, generally r-th degree polynomials in n variables, approximating them with piecewise-linear functions in each variable. The classifier contains also a comparator which, upon receiving instructions from a command commutator and interacting with the permanent computer memory, sends signals to the robot-manipulator servomechanism. In this way the system ensures quasi-optimal control of the sorting process, minimizing the overall cost of classification errors. Figures 2, references 2 Russian. [96-2415]

HIGH-ENERGY DEVICES, OPTICS AND PHOTOGRAPHY

UDC 681.513.1:621.313.14

ROTATION RATE STABILIZER FOR THE MOTOR OF A HIGH SPEED PHOTORECORDER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 271-272
manuscript received 2 Jan 79, final version received 19 Dec 79

DASHUK, S. P.

[Abstract] The chamber of a high speed photorecorder contains an electromagnetic transducer which generates a bipolar voltage pulse when an assigned angle is reached between the plane of a mirror and the optical axis of the chamber. The signal from the transducer is converted to a monopolar negative pulse. The pulses are divided alternately and sent to time measurement circuitry used to control the rotation of the motor which rotates the device. This allows a potentiometer to be used to control the speed of the motor. A schematic diagram of the automatic speed stabilization circuit is presented. The accuracy of speed stabilization in the 22,500-90,000 rpm range is 0.15%, in the 5,000-22,500 rpm range - 0.2%. The unit can be used to stabilize the rotating speed of more powerful motors if the proper thyristor size is selected. Figure 1, reference 1 Russian.
[80-6508]

UDC 681.7.07

SCANNER FOR OPTICAL INSTRUMENTS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 269-271
manuscript received 7 Dec 78

PISAREVA, T. Ye. and PUCHKOV, V. N., Siberian State Scientific Research Institute of Metrology, Novosibirsk

[Abstract] A description is presented of the design of a scanning device which can be used to develop instruments similar to laser infrared spectrometers, a combination of a high speed monochromator and a scanning multipath interferometer. Angular scanning of the spectrum is achieved by the use of an electromagnetic drive which moves a mount carrying the optical element back and forth between two electromagnets. A weight on the mount can be adjusted to produce mechanical resonance at the desired oscillating frequency. A modified piezoceramic device with a mechanical amplifier is used to increase the scanning amplitude of the mirrors of the interferometer.

The device consists of a piezoceramic ring unit, a mechanical amplifier and a mirror. The mechanical amplifier, a membrane, transmits the elongation of the piezoceramic rings under the influence of the voltage to the mirror of the interferometer. Figures 2, references 5 Russian.
[80-6508]

UDC 621.375.826.535.822

LABORATORY INSTALLATION FOR THE CREATION OF A LASER PROBE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 268
manuscript received 20 Feb 79

MERKIN, M. R., LABRENYUK, V. A., KOSTIN, V. K. and YULISH, V. I.

[Abstract] The installation described in this article consists of the stage of a photographic enlarger, a laser and a microscope with a slightly altered prism head. The laser replaces the enlarger; the microscope is installed beneath the laser. The installation is used to study phosphors, semiconductors, metal films, and also to examine photographic masks, the insulation of individual elements and to model failures in integrated circuits. At the maximum intensity, a film of aluminum 1.5-2 μm thick can be evaporated locally. Figures 2.
[80-6508]

UDC 535.373.3

INSTALLATION FOR STUDY OF ELECTRON ENERGY TRANSFER BETWEEN EXCITED STATES IN DONOR-ACCEPTOR SYSTEMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 243-245
manuscript received 9 Apr 79

SALAKHIDDINOV, K. I., SAGUN, Ye. I., ZEN'KEVICH, E. I. and GURINOVICH, G. P., Institute of Physics, Belorussian Academy of Sciences, Minsk

[Abstract] An installation has been developed with separate and simultaneous laser photoexcitation of molecules in a donor-acceptor system and subsequent recording of the kinetics of attenuation of fluorescence of the donor both with and without triplet-excited acceptor molecules in order to record the excitation energy transfer involved and study its regularities. Pyrene was used as the electron excitation energy donor, Mg-phthalocyanine as the acceptor. The mean fluorescence time of pyrene without the triplet excited molecules was 380±20 ns, the mean lifetime of fluorescence of the donor with 100% transfer of acceptor molecules to the triplet state was 270±15 ns. Figures 2, references 5: 2 Russian, 3 Western.
[80-6508]

UDC 621.386.14

HIGH VOLTAGE UNIT OF A SHORT X-RAY PULSE GENERATOR WITH A THREE-ELECTRODE TUBE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 224-225
manuscript received 8 May 79

BELKIN, N. V., KHUDYAKOVA, L. N., BOGOLYUBOV, V. V. and TARAKANOV, M. Yu.

[Abstract] A small x-ray pulse generator operating at 500 kV is described. The high voltage section includes a stepup transformer in a metal body, with the primary winding consisting of 4 turns of copper strip 80 mm wide; the secondary winding consists of 0.6 mm diameter wire at a spacing of 1 mm on thinwall conical insulators of organic glass, with a total of 160 turns. The radiation of the device was recorded at a distance of 10 cm from the anode of the tube by a semiconductor detector. The radiation pulse was bell shaped, 200 ns in length at the base, the length being little dependent on anode voltage. The variation in x-ray dose as a function of accelerating voltage is graphed. Figures 3, references 6 Russian.
[80-6508]

UDC 538.082.74:621.3.013.34

INSTALLATION FOR MEASUREMENT OF MAGNETIZATION IN STRONG PULSED MAGNETIC FIELDS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 207-210
manuscript received 24 Apr 79

JUSZCZYK, S. and KUBIAK, S., Institute of Physics, Silesian University, Katowice, Poland

[Abstract] A report is presented on an installation which records the process of magnetization in pulsed magnetic fields of up to 20 teslas with a pulse duration of 20 miliseconds in the 4.2-350 K temperature range. The installation includes the pulsed field generator and circuits which measure the induction of the field and magnetization. A battery of 20 capacitors is charged to a voltage of 5-10 kV over a period of 1 minute, storing a maximum energy of 100 kJ. Discharging the capacitors through a coil produces the strong magnetic field. The installation was calibrated using specimens of iron, cobalt and nickel in the form of 4 mm diameter cylinders of various lengths. The error in measurement of magnetization and induction of the field was about 5%. The sensitivity of the installation allows specific magnetizations to be measured with an accuracy of ~1 A·m^2/kg in cylindrical specimens 6 mm in length and 4 mm in diameter. Figures 3, references 6: 2 Russian, 4 Western.
[80-6508]

UDC 538.61

INSTALLATION FOR LOW TEMPERATURE SPECTRAL STUDIES IN STRONG PULSED MAGNETIC FIELDS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 204-207
manuscript received 10 Jul 78

KHARLAMOV, B. M., ULITSKIY, N. I., PYNDYK, A. M., PODOBEDOV, V. B. and PERSONOV, R. I., Institute of Spectroscopy, USSR Academy of Sciences

[Abstract] A description is presented of a pulsed installation for spectral studies in magnetic fields of up to 500 kOe at temperatures of 4.2 to 77 K. The installation contains a pulsed magnet with a battery of condensors, a nitrogen-helium cryostat, a pulsed light source and an optical system for input and output of radiation from the specimen, plus a high speed spectral recording system and a synchronization system. Tests involving observation of the Zeeman effect in a strong pulsed magnetic field indicate that the system operates satisfactorily and can be used to study the influence of strong magnetic fields on the spectra of complex molecules. Figures 4, references 10: 7 Russian, 3 Western.
[80-6508]

UDC 621.383.4/5.621.375.4

PHOTORECEPTOR WITH GOOD BACKGROUND RADIATION STABILITY

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 191-195
manuscript received 26 Mar 79

NIKONOV, B. S., TRISHCHENKOV, M. A. and OKUN', S. D.

[Abstract] Photoreceptors consisting of a photodiode and an opamp with a resistance in the feedback circuit are used to record weak light signals. The resistance must be very high to achieve a low threshold, but this results in a lack of sensitivity to a variable signal even when the background radiation level is low. In order to achieve good background radiation stability, a recognition characteristic distinguishing the signal from the background, such as rate of change, must be used. This article describes a circuit based on frequency selection with a low-noise optron couple used as the compensating oscillator which is the main element of the circuit. High background stability is achieved. Figures 4, references 8: 6 Russian, 2 Western.
[80-6508]

UDC 539.1.074/537.533.8

DIELECTRIC CHARGED PARTICLE DETECTOR WITH KCl WORKING SUBSTANCE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 47-50
manuscript received 8 May 79

GUKASYAN, S. M., KAVALOV, R. L., LORIKYAN, M. P., TROFIMCHUK, N. N. and
KHACHATRYAN, R. Zh.

[Abstract] A description is presented of a dielectric particle detector in which the operating substance is a porous layer of KCl. The unit operates as follows: δ electrons formed by a particle which has passed through the walls between the pores in the dielectric are accelerated by an electric field. Colliding with the walls of other pores, these electrons release still more, producing an avalanche of electrons, generating current pulses on the anode filaments around the dielectric layer. When the anode filaments are connected to a common 50 ohm load, an oscilloscope with a bandwidth of 200 MHz produces a triangular pulse with a leading edge length of ~2.5 ns, trailing edge ~3.5 ns, amplitude ~10 mV each time a particle passes through the system. The α-particle recording efficiency of the device gradually decreases with increasing operating time. Figures 2, references 12: 9 Russian, 3 Western.
[80-6508]

UDC 539.1.074.9

PROCESSING OF GLASS TRACK DETECTORS WITH THE MAGMO INSTALLATION

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 39-41
manuscript received 11 Mar 79

KOPCHENOV, V. Ye. and NIKOLAYEV, V. A.

[Abstract] The authors have developed a method for measurement of the diameters of tracks in glass using the MAGMO ("machine analysis of the geometry of microscopic objects") installation. The device can be used to study the field of an object measuring 40 x 20 mm^2, dividing the field into stripes 25/K mm in width, where K is the optical magnification of the microscope. The transition from strip to strip is automatic. The resolution of the device is studied and it is found that the best resolution is that of the S (sum) mode, counting the sums of quanta from all chords which intersect the track. Figures 3, references 5: 4 Russian, 1 Western.
[80-6508]

UDC 539.1.07:539.124.6

HIGH SPEED POSITRON LIFETIME SPECTROMETER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 33-35 manuscript received 5 Feb 79

VALUYEV, N. P., Scientific Research Institute of Ferrous Metallurgy, Moscow

[Abstract] The speed of apparatus used to measure the lifetime of positrons can be increased by introducing fast coincidence circuits to the time channel, controlled by the pulse shapers of the radiation detectors and high-speed amplitude discriminators. This article describes a device utilizing this principle and capable of a time resolution of one half nanosecond with a loading of one million pulses in the channels which record nuclear and annihilation gamma quanta. The device can be used to study various structural transformations in metals and alloys, as well as for rapid analysis of the annihilation characteristics of positrons in various solids, liquids and gases. Figures 2, references 5: 4 Russian, 1 Western.
[80-6508]

UDC 539.172.12

MEASUREMENT OF FUNCTIONS OF EXCITATION OF NUCLEAR REACTIONS IN A BEAM WITH A BROAD ENERGY SPECTRUM

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 28-30 manuscript received 21 May 79

ARTEMOV, S. V., ZAPAROV, E. A., NAZITOV, B. S. and YAKUSHEV, V. P., Institute of Nuclear Physics, Uzbek Academy of Sciences, Tashkent

[Abstract] A method is suggested for eliminating the overlap of spectra in an accelerator with expanded spectrum using a decelerator with periodically changing thickness. This article describes an experiment involving elimination of superimposition of spectra in a beam of cyclotron protons. The detecting systems is a mosaic of semiconductor detectors located in the focal plane of the channel of a multiple-head magnetic spectrograph. The mosaic is a set of 24 band detectors deposited on silicon plates. The detection method significantly expands the range of nuclei for which the method of energy expansion of the beam can be used. Figures 3, references 6: 3 Russian, 3 Western.
[80-6508]

UDC 621.384.633:539.12...18:621.3.095.222

DEVICE FOR UNIFORM BOMBARDMENT OF THE SURFACES OF SPECIMENS WITH A BEAM OF IONS FROM AN ACCELERATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 25-27
manuscript received 5 Apr 79

GUSINSKIY, G. M. and IZOTOV, A. L., Institute of Physics and Technology, USSR Academy of Sciences

[Abstract] Uniform bombardment of a surface of a specimen is achieved by scanning a beam of ions, focused to 5 x 5 mm^2. The ion guide of a cyclotron passes along 2 focusing quadrupole lenses which achieve the vertical and horizontal scanning of the beam by modulation of the current in the windings. The dose of implanted ions is measured on the basis of the charge transferred to the target by the ion stream. Figures 2, reference 1 Russian.
[80-6508]

UDC 537.533:621.3.029.6

MICROWAVE ELECTRON INJECTOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 23-25
manuscript received 16 Jul 79

ZAKUTOV, Ye. M. and KIRPICHNIKOV, G. A., Institute of Chemical Kinetics and Combustion, Siberian Branch, USSR Academy of Sciences, Novosibirsk

[Abstract] A microwave injector with a hot cathode is described, yielding a stable electron beam with a narrow energy spectrum and steep current pulse edges. The entire structure which accelerates and bunches electrons emitted by the flat thermionic cathode consists of 3 axial resonators separated by drift regions. The operating frequency of the system is 3 GHz. The device has a stable output characteristic over a detune range of -0.6 to +0.5; there is no high static voltage in the injector, allowing a rectangular pulse generator with an amplitude of 70-100 V to be used to modulate the beam. The rise time of the injected current pulse is determined by the rise time of the modulating pulse. Figures 2, references 3 Russian.
[80-6508]

UDC 681.3

SYSTEM FOR STABILIZATION AND CONTROL OF THE ENERGY OF A BETATRON

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 21-23
manuscript received 20 Jun 79

KOZIN, A. B., SEMENOV, V. A., BELYAYEV, S. N. and NECHKIN, A. A., Scientific Research Institute of Mechanics and Physics, Saratov State University

[Abstract] A betatron energy stabilization system is suggested, a development of a multichannel automatic device for measurement of the outputs of photonuclear processes. The voltage induced in a tracking coil located in the vacuum chamber of the betatron at the radius of the equilibrium orbit is used to produce a voltage coinciding in phase with the magnetic field of the device. An active filter based on an opamp is used as a phase shifter for production of a voltage which is an analog of the magnetic field. The betatron energy control system here suggested has been tested over a period of several months. The characteristic points were identified with an accuracy of 10 keV and did not shift along the betatron energy scale during the test period. Figures 3, references 8 Russian.
[80-6308]

UDC 629.78.018

ERRORS IN RADIATION IN CYLINDRICAL SIMULATORS OF THE THERMAL EFFECT OF PLANETS ON CYLINDRICAL FLIGHT VEHICLES

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 40, No 3, Mar 81 p 538
manuscript received 6 May 80, abstract received 19 Aug 80

[Abstract of paper deposited at the All-Union Institute of Scientific and Technical Information, No 4199-80 Dep.]

KOLESNIKOV, A. V.

[Abstract] The author defines and analyzes the errors in radiation which may occur in cylindrical thermal planetary radiation simulators designed to imitate the influence of planets on cylindrical spacecraft. The problem is defined as requiring determination of the distribution of intensity of radiation over the surface of the simulator and determination of the error in irradiation of the flat heat-receiving elements parallel to the axis of the simulator but at a certain angle to the elements of the circular cylinder of which the simulator consists. Only the first portion of the problem is studied in detail in this work. Results are simply presented which if utilized will achieve relative errors in irradiation of the elements of the lateral surfaces of a circular cylinder of not greater than -3 to +4% with respect to conditions in orbits 200 to 400 km above the surface of the earth. The irradiation by the planet was modeled using a mathematical model composed for a homogeneous diffuse model of planetary radiation. The temperature errors calculated

indicate that when the simulator is adjusted to any surface of a circular cylinder coaxial with the simulator, in other heat-receiving elements not coinciding in their orientation with the corresponding elements of the surface of the circular cylinder, significant errors arise: the relative irradiation errors may be as great as 35%, the temperature errors as great as 25 K. It is therefore concluded that the type of simulators studied can be used only to reproduce the thermal influence of planets on linear surfaces without bend points. The original article had 5 references.
[105-6508]

UDC 629.78.018

INCREASE IN DIMENSIONS OF OPERATING ZONE OF A SIMPLE PLANETARY RADIATION SIMULATOR BY THE USE OF A CONICAL MIRROR

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 40, No 3, Mar 81 pp 537-538
manuscript received 2 Apr 79, abstract received 1 Jul 80

[Abstract of paper deposited at the All-Union Institute of Scientific and Technical Information, No 4091-80 Dep.]

KOLESNIKOV, A. V.

[Abstract] The author develops and gives a basis for a method for approximately tripling the relative dimensions of the operating zone of a simple simulator that reproduces the field of radiation of homogeneous diffuse planet models. The method is based on the use of the energy of radiation of an imaginary image of a diffusely radiating disk or the cavity of a planet simulator in a conical mirror coaxial with the diffuse radiator and having strictly defined geometric parameters, relative height and cone aperture angle. The equations used to define the geometric parameters of the mirror are presented. They are derived on the basis of the condition of exclusion of the possibility of appearance of certain undesirable factors which hinder the use of the energy of an imaginary image of a diffuse radiator in a simulator. The original article has three references.
[105-6508]

FLUID MECHANICS

UDC 533.696.4

INFLUENCE OF VISCOSITY ON FLOW AROUND A SHARP EDGE OF SEGMENTALLY CONICAL BODIES

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian No 1, Jan-Feb 81 pp 154-157 manuscript received 23 Jun 80

KARPEYSKIY, Yu. Ya. and FILIPPOV, K. N., Moscow

[Abstract] A segmentally conical body is defined as one consisting of a spherical segment at the front and a tapering cone at the rear, a cylinder with a flat front face representing the extreme case. Axisymmetric supersonic flow around the edge between both segments (cylinder face) was studied experimentally, for the purpose of establishing the dependence of the flow behavior, boundary layer and separation zone, on the Reynolds number and thus the gas viscosity. Measurements were made over the N_{Re}= 80-17^7 range of the Reynolds number, covering laminar and turbulent boundary layers, at a Mach number N_{Ma}= 3 or higher. An evaluation of the data has yielded relations for the length of the separation zone $1/D_m$ (referred to the diameter D_m of the edge circle or cylinder face)

$$1/D_m = 0.28\, N_{Re}^{-0.32}$$

and for the pressure in the separation zone p/p_0' (referred to the full pressure p_0' behind the forward jump

$$p/p_0' = 65\, N_{Re,0}^{-0.65}$$

($N_{Re,0}$ denoting the Reynolds number based on the stagnation parameters and the acoustic velocity) in the case of a laminar boundary layer. An appreciable shortening of the separation zone was found to occur within the N_{Re} = 10^5-10^7 range. The pressure in the separation zone in the case of a turbulent boundary layer can be represented as the sum of the pressure of a nonviscous gas and a correction accounting for the viscosity, the empirical relation

$$p/p_0' = 2.3 \sin^7 0.4(130^\circ - (\theta_s^\circ + \theta_c^\circ) + 0.008$$

fitting the experimental data (angle θ_s between tangent to the spherical segment at the edge and the axis, angle $_c$ between generatrix of the cone and the axis). Figures 4, references 3 Russian.
[92-2415]

UDC 532.516

DISCHARGE OF A VISCOUS GAS FROM A CYLINDRICAL CHANNEL INTO VACUUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian No 1, Jan-Feb 81 pp 122-128 manuscript received 4 Jul 80

BELOSHITSKIY, A. V. and BONDAREV, Ye. N., Moscow

[Abstract] Discharge of a viscous gas from a cylindrical channel into vacuum bounded by a plane flange surface is analyzed on the basis of the Navier-Stokes equations for a compressible fluid in such a system. This system of partial differential equations is replaced with an approximating system of difference equations in the implicit scheme. Appreciable errors in the numerical solution are avoided by performing the calculations in three stages, first for a channel opening into unbounded vacuum. The flow parameters near the orifice edge are then refined in the second stage for use as boundary conditions in the third stage of calculating the flow in vacuum bounded by a plate. Typical results for a gas with the ratio $k= c_p/c_v= 1.4$ discharging from a channel where the flow is laminar ($N_{Re}= 200$) are compared with experimental data. The dependence of the flow pattern, namely the velocity (Mach number) distribution, on the ratio L/N_{Re} of channel length to Reynolds number is established next. The effect of sliding, assuming no friction and heat transfer, on the flow pattern in vacuum is also calculated and shown in the form of isomach lines for $N_{Re}= 10^7$ ($L/N_{Re}= 0.002$, 0.06) and $N_{Re}= 5000$ ($L/N_{Re}= 0.002$). Pressure profiles have been calculated for the latter case. Figures 6, references 6 Russian.
[92-2415]

UDC 533.6.011.55:532.582

SHAPE OF A BODY DISINTEGRATING IN A SUPERSONIC GAS STREAM

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA ZHIDKOSTI I GAZA in Russian No 1, Jan-Feb 81 pp 18-21 manuscript received 4 Jul 80

KALASHNIK, V. N., KILLIKH, V. Ye., PETROV, G. I., POLEZHAYEV, Yu. V., SMIRNOV, A. N. and CHUDETSKIY, Yu. V., Moscow

[Abstract] Models of bodies disintegrating in a supersonic gas stream are considered which simulate cosmic bodies entering the atmosphere. A theoretical-experimental study of gas dynamics and heat transfer yields data on the shape of such bodies and its dependence on some stream characteristics, namely its Reynolds number and Mach number. The material for these models was highly homogeneous polymethyl methacrylate with a serrate surface roughness and without a film of melt on the disintegrating surface. Formation of a meteoritic shape is found to be attributable to an increase of the Reynolds number alone, while formation of shatter cones is found to be possible only within a high range of both the Reynolds number and the Mach number. The threshold value of the Reynolds number at which transition from laminar bluntness to a meteoritic shape begins depends on several factors, a serrate surface

roughness having been found to lower the threshold of transition from laminar to turbulent flow into the subsonic range. Serration has also been found to strongly influence the distribution of thermal flux over the body (model) surface. Figures 4, references 5 Russian.
[92-2415]

UDC 532.54:519.34

APPROXIMATE METHOD OF SOLUTION FOR NONLINEAR PROBLEMS OF DYNAMICS OF A FLUID IN A VESSEL MOVING IN A GIVEN MODE

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 89-96
manuscript received 25 Dec 78

LUKOVSKIY, I. A., Institute of Mathematics, UkSSR Academy of Sciences, Kiev

[Abstract] A vessel partly filled with an ideal incompressible fluid is moving in space in a manner characterized by the vector of linear velocity and the vector of instantaneous angular velocity relative to some point. The problem is to determine the motion of the fluid particles inside this vessel and the forces of vessel-fluid interaction. The problem is formulated as the Laplace equation for the velocity potential with nonlinear boundary conditions, which can be derived from the Hamilton principle with the appropriate Lagrangian. It can thus be reduced to the equivalent corresponding variational equation with nonlinear boundary conditions. For an approximate solution, the velocity potential is resolved into three components: two scalar products of harmonic vectors characterizing the motion of the vessel and one scalar function characterizing the motion of the fluid in the vessel at rest. The latter is sought as the sum of an infinite series of products of space harmonics and time functions. This series of time functions describing the change of the velocity potential and another series of time functions describing the deviation of the free surface from its quiescent position are found from two infinite systems of differential equations, one linear and one nonlinear. References 6 Russian.
[94-2415]

UDC 533.6.011.08

CALCULATION OF THE FORCE ACTING ON PART OF A BODY IN A SUPERSONIC GAS JET IN THE PRESENCE OF AN ACCOMPANYING EXTERNAL SUPERSONIC FLOW

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHANSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian Vol 1, No 2, 1980 pp 51-55 manuscript received 19 Nov 79

ALIYEV, N. M. and MIRZOYEV, I. M., Institute of Mathematics and Mechanics

[Abstract] A steady uniform underexpanded supersonic gas jet discharges from a profiled nozzle into an accompanying uniform supersonic flow in the wake of a body which has the shape of a wedge with a flat end face parallel to the oncoming stream

as well as to the jet axis. The calculation of forces acting on the part of this body in the flow is based on earlier obtained analytical solutions to the equations of the perturbation potential in the various regions of the flow field, with the corresponding boundary conditions. With the angle of attack fixed, the relative magnitudes of these forces (lift and drag) depend on the form of the surface in the flow. This is demonstrated by letting the function y= f(x) in the equation of that surface be either a monotonically falling or a monotonically rising one. Figure 1, references 3 Russian.
[95-2415]

UDC 532.526:536.24

TEMPERATURE FIELD OF A PLATE WITH LOCAL HEAT SINKS, HEATED BY A LAMINAR FLOW OF A COMPRESSIBLE GAS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 40, No 3, Mar 81 p 546
manuscript received 16 May 80, abstract received 30 Jul 80

[Abstract of paper deposited at the All-Union Institute of Scientific and Technical Information, No 4095-80 Dep.]

GLUSHAKOV, A. N. and LOSEV, N. V.

[Abstract] The article deposited at the studies a thin heat-conducting plate which is warmed by a laminar flow of a compressible gas. Using the known distribution of velocities in the boundary layer, the equation for energy with Pr=1 and linear variation of viscosity as a function of temperature is presented and solved by means of a Laplace transform. An example of calculation of the temperature field of a plate is studied for the case in which the function characterizing the distribution of sectors of heat exchange along the length of the plate is periodic with alternating sectors of heat exchange and heat insulation. The original article has 3 references.
[105-6508]

UDC 532.517.4

INFLUENCE OF ARCHIMEDES FORCE ON LENGTH OF MIXING ZONE OF A FREE TURBULENT JET

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 40, No 3, Mar 81 pp 533-534
manuscript received 7 Apr 80, abstract received 18 Jul 80

[Abstract of paper deposited at the All-Union Institute of Scientific and Technical Information, No 3671-80 Dep.]

SHEVYAKOV, G. G., TOMILIN, V. P. and KONDRASHKOV, Yu. A.

[Abstract] The process of mixing in a vertical axisymmetrical turbulent jet is analysed considering the effect of Archimedes force. The jet of gas is considered

to have a density different from the surrounding medium. Solution of the equations describing the jet produces relationships characterizing the variation in relative length of the mixing zone as a function of the ratio of densities and Froude number. The results of calculation are compared with experimental data obtained by discharging jets of hydrogen into air from pipes of various diameters from 6 to 96 mm. Archimedes force is found to have a significant influence on the process of mixing in the jet, reducing the relative mixing length with decreasing Fr number. The work also calculates the depth of penetration of the hydrogen jet into air when it is discharged vertically downward. Figure 1, references 3 [original article contains 14 references].
[105-6508]

MECHANICS OF SOLIDS

UDC 539.3:534.1

ASYMPTOTIC EXPRESSION FOR THE NATURAL FREQUENCIES OF NONCIRCULAR CYLINDRICAL SHELLS FILLED WITH FLUID

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 45, No 1, Jan-Feb 81 pp 180-185 manuscript received 4 Apr 79

DAIN, Ye. A., Moscow

[Abstract] An exact asymptotic expression is derived for the natural frequencies of noncircular cylindrical shells, specifically a right cylindrical shell of arbitrary cross section with two plane elastic lids at both ends and completely filled with a fluid. The system of five equations of motion, four for the lateral shell surface and one Helmholtz equation for the fluid, is based on the assumption of a zero velocity potential on the lids and free supports at the edges. A theorem is proved, namely that the spectrum of the problem is real and discrete with a single limiting point at infinity and with eigenvalues symmetric with respect to zero. Accordingly, the system of equations is reduced to one with a small parameter and then to an equivalent pseudodifferential equation of the eigenvalue problem. Another theorem is proved which yields the number of eigenvalues in the spectrum. References 4: 2 Russian, 2 Western.
[93-2415]

UDC 539.3:534.1

DIFFRACTION OF ACOUSTIC WAVES BY AN IDEAL SHIELD INSIDE A PLANE WAVEGUIDE WITH THIN ELASTIC WALLS

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 45, No 1, Jan-Feb 81 pp 145-153 manuscript received 1 Jul 80

LEVITSKIY, L. A. and LUK'YANOV, V. D., Leningrad

[Abstract] A plane horizontal waveguide is considered with elastic walls and a thin vertical shield inside across the lower half. The acoustic field in this waveguide is described by the homogeneous Helmholtz equation with the boundary conditions of a mechanically perfect surface at the upper wall, a solid contact between the shield and the lower wall, and for the shield either the Dirichlet condition

(perfectly soft) or the Von Neumann condition (perfectly rigid). A normal pressure wave symmetric with respect to the transverse coordinate is diffracted by the shield as it impinges on it from one side. The total pressure field can be split into two parts, one odd and one even with respect to the longitudinal coordinate. The corresponding two independent problems are solved for what has become a semi-infinite waveguide. The diffraction problem is also solved for boundary-contact conditions given in terms of impedance with either zeroth or fourth-order differential operators. Figure 1, references 7 Russian.
[93-2415]

UDC 531.36

LIBRATION POINTS NEAR A GRAVITATING ROTATING TRIAXIAL ELLIPSOID

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 45, No 1, Jan-Feb 81
pp 26-33 manuscript received 16 Oct 79

KOSENKO, I. I., Moscow

[Abstract] The motion of a passively gravitating point is considered near the relative-equilibrium positions of a uniformly rotating homogeneous ellipsoid with three arbitrarily long semiaxes. The system of Hamilton equations for this system is obtained by a Legendre transformation to canonical phase coordinates. Libration points are established in the equatorial plane, upon differentiation of the H(p,q) equation, and their stability region is also established. A theorem for an ellipsoidal but sufficiently close to spherical planet is then proved, on this basis, namely that the stability of a libration point here depends, in the first approximation, only on the shape of the planet and not on its mass, size, or angular velocity. This theorem can be extended to prolate ellipsoids. The author thanks V. G. Demin for suggesting this topic as well as for his help and support. Figures 5, references 6: 4 Russian, 2 Western.
[93-2415]

UDC 539.3:534.1

VIBRATION MODES OF A LONG CYLINDER IN THE HIGH-FREQUENCY RANGE

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 127-130
manuscript received 25 Sep 79

KOMISSAROVA, G. L., Institute of Mechanics, UkSSR Academy of Sciences, Kiev

[Abstract] The frequency spectrum of a long cylinder is examined and its vibration modes are classified for a material with the Poisson ratio $\nu = 0.2$ rather than zero in the simpler ideal case. In the vicinity of the $\Omega_E \approx 1.67$ resonance there appear an E-mode and L-modes as well as transition modes. Above the $\Omega_1 = \frac{\omega R}{V_D} = 1.841$ frequency (R- radius of the cylinder and V_D- velocity of an expansion wave) there appear an A-mode and L-modes. This classification is verified by an analysis of axial displacements $w(r)$ along the radius of the cylinder base $z = h$. The modes within the $1.794 < \Omega_1 < 1.841$ range cannot be classified precisely, because the frequency spectrum $\omega(h)$ (h- ratio of length to radius) has no plateau here, but B-modes are certain to appear along with A-modes and L-modes. Figures 5, references 7: 4 Russian, 3 Western.
[94-2415]

UDC 534

DAMPING THE VIBRATIONS OF MECHANICAL SYSTEMS BY MEANS OF CAVITIES PARTLY FILLED WITH LOOSE MATERIAL

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 110-115 manuscript received 14 Nov 78

BRISKIN, Ye. S., Volgograd Polytechnic Institute

[Abstract] A new kind of vibration absorber is a cavity partly filled with loose material. Here a phenomenological model of this material is developed, on the basis of theoretical and experimental studies, which will describe the performance and serve as a design guide. The model is a beam with a uniform cross section and viscous resistance, approximating an elastic-dissipative body. Its properties depend, however, not only on the excitation intensity but also on the vibration frequency and on the clearance under the cavity ceiling so that it becomes more precisely a quasi-elastic-dissipative one. The equations of motion in the specific case of vertical vibrations are expressed in integral rather than differential form, inasmuch as the boundary conditions cannot be sharply defined. The solution yields approximate expressions for the amplitude and the dynamicity factor of the main damping system as well as for the resonance frequency which will ensure maximum dynamicity and the corresponding logarithmic decrement. An experiment with an electromagnetic excitation system has yielded data for the empirical relations also

needed for calculating the logarithmic decrement. In order to properly space the cavities, it is necessary to know the logarithmic decrement for each vibration mode. A general expression is derived for this purpose on the basis of the energy dissipated per cycle and by applying the principle of superposition. Figures 3, references 9 Russian.
[94-2415]

UDC 539.3

TRAVELING WAVES IN LONGITUDINALLY REINFORCED CYLINDRICAL SHELLS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 40-45
manuscript received 21 Dec 79

ZARUTSKIY, V. A., Institute of Mechanics, UkSSR Academy of Sciences, Kiev

[Abstract] Homogeneous equations of motion for a thin elastic cylindrical shell with a regular array of discrete longitudinal reinforcing stringers are derived on the basis of Kirchhoff-Love and Kirchhoff-Clebsch hypotheses. The general solution to this system of equations and the dispersion equations reveal three types of long traveling waves and their cutoff frequencies. Each type is determined by different stiffnesses of the stringers: 1) only by their flexural stiffness in a radial plane and their tensile-compressive stiffness, 2) only by their flexural stiffness in a plane tangent to the sheath and their torsional stiffness, 3) by all these stiffnesses. References 6 Russian.
[94-2415]

UDC 539.3

STABILITY OF AN INCOMPRESSIBLE ELLIPTICAL CYLINDER UNDER FINITE STRAINS

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 36-39
manuscript received 31 Mar 80

MUSAYEV, D. A., Institute of Mathematics and Mechanics, AzSSR Academy of Sciences, Baku

[Abstract] The static stability under subcritical finite strains of a cylindrical rod with an elliptical cross section, made of an incompressible and transversely isotropic material, is analyzed on the basis of the linearized three-dimensional theory of elasticity. The equations in Lagrangian coordinates for such a rod on hinge supports are solved by reducing the variational equation for the functional of displacement and a Lagrange multiplier to the two-dimensional case in expanded form. As an example, calculations are shown for a neo-Hookian body with a Treloar elastic potential. Figure 1, references 4 Russian.
[94-2415]

UDC 534.21

TRANSIENT INTERACTION OF AN ELASTIC SPHERICAL BODY AND AN ACOUSTIC MEDIUM

Kiev PRIKLADNAYA MEKHANIKA in Russian Vol 17, No 2, Feb 81 pp 22-28
manuscript received 30 Nov 78

PODSTRIGACH, Ya. S., GALAZYUK, V. A. and GORECHKO, A. N., Institute of Applied Problems in Mechanics and Mathematics, UkSSR Academy of Sciences, L'vov, L'vov State University imeni I. Franko

[Abstract] An isotropic elastic spherical shell is considered in an acoustic medium. The centrosymmetric problem of interaction is analysed on the basis of Lamé equations of motion in orthogonal coordinates and their resolution with respect to three separate scalar wave functions, one of which vanishes identically if the body has been at rest at time zero and another one vanishes identically if the elastic material has a zero shear resistance. The problem of transient interaction in response to a probing wave or pulse of finite duration is then solved with the aid of the Laplace transformation. Pressure and displacement transients are calculated, typical results shown for a steel shell filled with a perfectly soft or perfectly rigid material and immersed in water. A numerical analysis of the solution indicates that the problem can be approximated with that of a plane layer at high frequencies when the shell is very thin and with that of a liquid sphere when the velocity of transverse waves is much lower than the velocity of lougitudinal waves in the material. Figures 2, references 7: 5 Russian, 2 Western.
[94-2415]

UDC 539.3+62.50

OPTIMAL CONTROL OF VIBRATIONS OF PLATES AND SHALLOW SHELLS AS A PROBLEM OF MATHEMATICAL PROGRAMMING

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 192-195 manuscript received 15 Jan 79

KARNOVSKIY, I. A., LANDA, M. Sh. and POCHTMAN, Yu. M., Dnepropetrovsk

[Abstract] The problem of optimally controlling the vibrations of a continuous object is treated as a problem of mathematical programming. The continuous object is accordingly replaced with a discrete model, by way of finite-difference approximations, so that this method will apply to linear as well as nonlinear objects with any kind of constraints. An algorithm of random search such as the algorithm of a sliding ellipse can be used for implementation of the optimal vibration control by this method. For illustration, it is applied here to a shallow shell in a state describable by a system of nonlinear equations with given initial and corresponding boundary conditions. It is also applied to a geometrically nonlinear plate whose vibrations are to be suppressed. The minimum correction time with an energy-limited

control mechanism serves as the optimality criterion in both cases. Typical numerical results are shown for a rectangular steel plate on a hinge support around its periphery, a problem formulated in 9 equations with 152 equality constraints and 4 inequality constraints. Figures 3, references 8 Russian.
[92-2415]

UDC 624.012.6:539.3

PREDICTING THE CARRYING CAPACITY OF CYLINDRICAL GLASS SHELLS FROM THE RESULTS OF NONDESTRUCTIVE TESTS UNDER INTERNAL PRESSURE

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 81 pp 68-72 manuscript received 10 Dec 79

ZOLOTAREV, P. F., Institute of Strength Problems, UkSSR Academy of Sciences, Kiev

[Abstract] A procedure is described for predicting the carrying capacity of cylindrical glass shells under internal pressure on the basis of nondestructive tests. Long (ratio of length to radius $L/R \simeq 3$) and thin (ratio of radius to wall thickness $R/H \simeq 15$) shells are considered, which would break first in the middle due to flexural hoop stresses. The problem reduces to establishing the relation between hoop stress σ_ϕ and pressure q in the most vulnerable zone. The procedure is based on this relation in the form $\sigma_\phi = -\frac{qR}{H} \pm C \frac{q}{1-q/q_{crit}}$. It involves measurement of axial and hoop strains during the initial stage of loading to relatively low pressure levels and subsequent analysis of the readings for calculation of the empirical constant C(q). Such tests were performed on cylindrical glass shells with shape imperfection characterized by a nonuniform wall thickness and an invariable ellipticity of the cross section, both tending to lower the carrying capacity. References 6: 5 Russian, 1 Western.
[89-2415]

UDC 539.4

DISTRIBUTION OF FORCES IN A TRIPLE-LAYER ROLLED PIPE

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 81 pp 73-76 manuscript received 15 Feb 79

VISLOBITSKIY, P. A., All-Union Scientific Research Institute of Main Pipeline Construction, Kiev branch

[Abstract] A triple-layer rolled pipe consists of a closed inside layer, a closed outside layer, and an open middle layer fastened at one end to the inside layer and at the other end to the outside layer. The distribution of forces in such a pipe

under both internal and external pressure is analysed here, assuming the width of the slip zone to be generally determined by the conditions of contact between layers. The role of friction forces is established and relations for the friction coefficient are derived which indicate its minimum value before the slip zone will encompass the entire contact zone. In the practical special case of zero external pressure this limiting value of the friction coefficient is found to be 0.068, which is less than the value for pairs of unlubricated steel surfaces (0.11). Figure 1, references 2 Russian.
[89-2415]

UDC 621.438.018

VIBRATION DIAGNOSIS OF GAS-TURBINE BLADES BASED ON THE LIMITING LEVELS OF TORSIONAL RUNNER VIBRATIONS

Kiev PROBLEMY PROCHNOSTI in Russian No 2, Feb 81 pp 114-117 manuscript received 11 Sep 78

BESKLETNYY, M. Ye. and IGUMENTSEV, Ye. A., Ukrainian Scientific Research Institute of Natural Gas, Khar'kov

[Abstract] Turbine and compressor blades must be tuned away from resonance in any dangerous vibration mode. A method of blade diagnosis for this purpose is proposed which involves measurement of the torsional runner vibrations at some accessible location. Conventional probes can be used for picking up the vibration signals, a harmonic analysis of which will then reveal the frequencies closest to resonance and indicate the level of dynamic stresses at those critical frequencies. If two successive tests at time $t = \tau, 2\tau$ show that the amplitude of at least one harmonic exceeds its permissible level, then a preventive replacement of the blade assembly will be necessary. The limiting vibration amplitudes and dynamic stresses are determined on the basis of an analysis of the dynamic runner-blades model with forced vibrations under a load which varies sinusoidally in time. The equations of motion are derived from the generalized Hamilton principle, with the blades regarded as continuous systems of twisted beams and the runner shaft replaced with a discrete array of lumped masses. The algorithm has been programmed for a digital computer and tested on a GTU-10-2 gas turbine plant including a multistage axial compressor. Figure 1, references 6 Russian.
[89-2415]

UDC 539.3

TRANSIENT RADIAL VIBRATIONS OF A PIECEWISE-HOMOGENEOUS ELASTIC SPACE WITH SPHERICAL SYMMETRY

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 96-101 manuscript received 5 Feb 80

GORSHKOV, A. G. and TARLAKOVSKIY, D. V., Moscow

[Abstract] An infinite isotropic and linearly elastic space is subdivided into concentric spherical shells, each different but homogeneous, around a source of waves at the center. At instant of time t= 0 the front of such an elastic spherical wave impinges on the innermost shell surface. The motion of this system of i layers is described by a system of i second-order partial differential equations with respect to the elastic potential in one space coordinate (radius) and time, with continuity of displacements and radial stresses as the boundary conditions at the contact surfaces. The transient response to a unit pulse is determined upon transformation of the system of differential equations to a system of Volterra integral equations of the second kind with a delay argument and convolutions. The solution can be extended from continuous functions to discontinuities of the first kind in time. A special case would be a system of acoustic shells. References 5: 3 Russian, 2 Western.
[91-2415]

UDC 539.621

TRANSIENT THERMOELASTIC STRESSES IN A ROTATING CYLINDER

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 102-108 manuscript received 18 Apr 79

BYSTROUMOV, V. A. and IGNASHOV, I. A., Vologda

[Abstract] A cylindrical roller of finite length in Lagrange coordinates rotates about its stationary axis at some angular velocity as a segment of its generatrix remains in contact with a forward moving strip of hot metal. The transient thermoelastic stresses in this roller are calculated from the equation of heat conduction in Euler coordinates with boundary conditions of the first kind and the Poisson equation for the displacement potential appearing in the components of the displacement vector as well as in the components of the stress tensor. In order to satisfy the boundary conditions here, it is necessary to select the appropriate form of the stress function and to superpose on the stresses the solution to the equations of the theory of elasticity for temperature T= 0. On this basis, the axial stresses in a roller of finite length and the bending moment in a cross section of an infinitely long cylinder have been calculated, with the temperature distribution over a cross section approximated by a finite series. That temperature distribution tends to

become axisymmetric and the bending moment tends to vanish as the Predvoditelev number becomes infinite. The transient stress distribution, with the Fourier number representing dimensionless time, is found to depend on the angular velocity of the roller. Figures 3, references 5 Russian.
[91-2415]

UDC 539.3:534.1

STABILITY OF VISCOELASTIC SHALLOW SPHERICAL SHELLS UNDER A VARYING LOAD

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 166-171 manuscript received 16 Oct 79

VOROVICH, I. I., MINAKOVA, N. I. and KALOMBET, P. P., Rostov na Donu

[Abstract] A shallow spherical shell of a viscoelastic material such as acrylic plastic describable by the Rabotnov aftereffect relation, without volume creep is considered with the constraint of rigid clamping around its contour. The stability of such a shell under a varying load is analyzed on the basis of the criterion of an infinite deflection rate at the critical time. The state of stress and strain is described by a system of dimensionless differential equations in operator form. The corresponding boundary-value problem is reduced to a system of second-order ordinary differential equations in time with finite differences in space coordinates. This system if solved by the Runge-Kutta method, after the initial conditions have been obtained from the appropriate system of nonlinear algebraic equations by the method of nonlinear relaxation, and with the derivatives on each step determined according to the scheme of optimal elimination. The functional of critical time periods and the deformation trajectories are then analyzed numerically for the specific case of a load increasing linearly with time from one level to another. Figures 4, references 5 Russian.
[91-2415]

UDC 539.3:534.1

LINEAR AXISYMMETRIC RESPONSE OF A COMPOUND SHELL OF REVOLUTION TO AN IMPACT LOAD

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 177-184 manuscript received 11 Oct 78

KOVALEV, A. M., Leningrad

[Abstract] A shell of revolution with variable thickness is considered which consists of two segments interfacing around some perimeter parallel to the bases, where a discontinuity or step change in physical and geometrical parameters occurs. Its linear response to an axisymmetric impact load imparting some initial velocity to the mass at one base is analyzed by the method of characteristics with a fixed grid,

only the discontinuities on this grid being retained and those not on this grid having to be extracted analytically. With the rates of change of the length of a meridional arc serving as the characteristics, expressions are derived for the discontinuities of velocities, forces and moments from the system of first-order equations in eight variables (longitudinal and transverse velocities, angular velocity of a normal to the surface, longitudinal and transverse forces, circumferential force, longitudinal and circumferential moments) on both sides of the interface. This system of equations is reduced to normal form by substitution of variables. The algorithm of calculating the response involves integration along the characteristics by the predictor-corrector method with second-order accuracy. Typical numerical results are shown for a shell consisting of a cone and an infinitely long cylinder, both made of the same material so that the velocities of tension-compression waves and of shear waves are correspondingly the same in both. Figures 3; references 5: 2 Russian, 3 Western.
[91-2415]

UDC 539.3:534.1

ASYMPTOTIC ANALYSIS OF PROBLEMS PERTAINING TO FREE VIBRATIONS OF A CYLINDRICAL SHELL IN CONTACT WITH AN ELASTIC MEDIUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: MEKHANIKA TVERDOGO TELA in Russian No 1, Jan-Feb 81 pp 185-191 manuscript received 10 Oct 79

BERGMAN, R. M. and LATIFOV, F. S., Baku

[Abstract] An elastic infinitely long closed circular cylindrical shell is considered in an infinitely large volume of an isotropic elastic material of a much lower stiffness. With the state of stress and strain assumed to be widely variable, the vibration modes and frequencies are calculated on the basis of an asymptotic analysis. The equations of motion for the shell in cylindrical coordinates are solved for the components of its displacement in the form of space and time harmonics, with the aid of the three equations of motion for the ambient medium and with the boundary conditions at the outside surface of the shell expressed in terms of displacements. Truncated asymptotic expansions replacing the ratio of the modified Bessel function of the second kind to its radial derivative lead to an approximate parametric equation of the third degree with respect to frequency, whose roots are conveniently examined also with the inertia of the ambient medium taken into account. References 10 Russian.
[91-2415]

UDC 536.21

UNSTEADY TEMPERATURE FIELD OF AN ORTHOTROPIC CYLINDER WITH MIXED BOUNDARY CONDITIONS

Minsk INZHENERNO-FIZICHESKIY ZHURNAL in Russian Vol 40, No 3, Mar 81 pp 544-545 manuscript received 13 May 80, abstract received 19 Aug 80

[Abstract of paper deposited at the All-Union Institute of Scientific and Technical Information, No 4198-80 Dep.]

DURGAR'YAN, S. M. and BAKHSHINYAN, R. M.

[Abstract] The article solves the problem of determination of the temperature field of a hollow infinitely long orthotropic cylinder with mixed boundary conditions fixed on its inner and outer surfaces. The solution of the problem is reduced to integration of the heat conductivity equation with defined initial and boundary conditions. An equation presents the final expression of the dimensionless temperature function. The solution of the problem for the particular case of a continuous cylinder can be obtained by means of a passage to the limit. Analysis of the numerical results indicates that regardless of the parameters of the problem with small cylinder thickness in all cross sections the distribution of temperature along the radius is near linear, whereas with increasing thickness significant nonlinearity arises. The calculations also show that consideration of the anisotropy of the physical properties of the material may introduce significant changes to the distribution of tmeperature in various cross sections. Reference 1 (original article has 5 references). [105-6508]

UDC 539.1.074.3

THERMAL STABILIZATION OF OPTICAL CHARACTERISTICS OF PLASTIC SCINTILLLATORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 1, Jan-Feb 81 pp 53-55
manuscript received 10 Aug 79

BEREZIN, I. A., GORBACHEV, V. M., NAZAROV, V. V., NEGINA, V. R., POPOV, V. N.,
STEN'GACH, I. N. and UVAROV, N. A.

[Abstract] A study is presented of the influence of long term heating on the light production, luminescence and absorption spectra of plastic scintillators. Polystyrene, PMMA and a copolymer of styrene and methylmethacrylate were used, exposed to heating at 115±5°C in air, argon and nitrogen over long periods of time. Light output was found to drop rapidly during the first two to three days of heating for all specimens. After 6 to 7 days the drop stopped and intensity of luminescence of the surface layer stabilized. It is found that the copolymer of styrene and methylmethacrylate has the best characteristics for operation at 100-120°C. Figure 1, references 5 Russian.
[80-6508]

CSO: 1861 - END -

END OF FICHE

DATE FILMED

June 26, 1981